ANALYTICAL CHEMISTRY DATA MANAGEMENT AND REVIEW FOR AIRNET

Purpose This procedure describes the process for receiving, uploading, and archiving analytical chemistry data; evaluating analytical chemistry quality; checking the resulting chemistry data packages for completeness and usability; and conducting validation/verification of both electronic and hardcopy data from both current and historical (pre-1996) sources.

Scope This procedure applies to the analytical chemistry coordinator assigned to evaluate AIRNET analytical data.

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Hazard Control Plan The hazard evaluation associated with this work is documented in HCP-ESH-17-Office Work.

Signatures
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01/14/00

General information about this procedure

Signatures,
continued

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Attachments   This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Checklist for Completeness of Data Package for Gross Alpha, Beta	1
2	AIRNET Analytical Data Validation and Verification Database Inspect	1
3	QC Evaluations Performed	1
4	Data Parameters	1

History of revision   This table lists the revision history and effective dates of this procedure.

Revision	Date	Description of Changes
0	02/06/98	New document.
1	12/7/99	Extensive revision of process, inclusion of steps formerly in ESH-17-208.

Who requires training to this procedure?   The following ESH-17 personnel require training before implementing this procedure:
- Analytical chemistry data reviewers
- Analytical Chemistry Coordinator

Training method   The initial training method for this procedure is **on-the-job** training by a previously trained individual, and is documented in accordance with the procedure for training (ESH-17-024).
Annual retraining is required and will be by self-study ("reading") training.

General information, continued

Prerequisites   In addition to training to this procedure, the following training is also recommended prior to performing this procedure:
- Education and/or experience in compliance-oriented analytical chemistry
- Familiarity with Microsoft Access
- Familiarity with the operation of the AIRNET database (see user's manual)

Definitions specific to this procedure

Statement of Work (SOW): A list of specifications and requirements which analytical laboratories must meet in order to do work for ESH-17.

Data Package: A hardcopy report from an analytical laboratory on a single set of chemical analyses, which contains the material specified in the SOW and sufficient documentation to allow an appropriate professional, at a substantially different time and location, to ascertain:
- what analyses were performed, and what results were obtained
- that the data had acceptable properties (such as accuracy, precision, MDA)
- where, when, and by whom the analyses were performed
- that the analyses were done under acceptable conditions (such as calibration, control, custody, using approved procedures, and following generally approved good practices)
- that the ESH-17 SOW was otherwise followed.

Defensible Data Package: A data package which the ESH-17 analytical chemistry coordinator and the QA Officer believe sufficient (based on EPA Contract Laboratory Program and best professional judgment) to prove the validity of chemistry results.

Completeness: A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under ideal conditions.

Usability: A qualitative decision process whereby the decision-makers evaluate the achievement of data quality objectives and determine whether the data may be used for the intended purpose. Three levels or classes of data quality are used:
- Accepted: Data conform to all requirements, all quality control criteria are met, methods were followed, and documentation is complete.
- Qualified: Data conform to most, but not all, requirements, critical QC criteria are met, methods were followed or had only minor deviations, and critical documentation is complete.

General information, continued

Definitions,
continued

- Rejected: Data do not conform to some or all requirements, critical QC criteria are not met, methods were not followed or had significant deviations, and critical documentation is missing or incomplete.

Electronic Data Deliverable (EDD): The computer-compatible file that is delivered to ESH-17 from the analytical laboratory, in the SOW-specified format, via Internet, e-mail, or diskette from which analytical chemistry data may be uploaded directly into the databases.

Validation: A systematic process for reviewing a body of data or a report against a set of criteria to provide assurance that the data or report are adequate for their intended use. Validation consists of data reviewing, screening, checking, auditing, verification, certification, and review.

Verification: The act of reviewing, inspecting, testing, checking, auditing, or otherwise determining and documenting whether items, processes, services or documents conform to specified requirements.

References

The following documents are referenced in this procedure:
- ESH-17-024, "Personnel Training"
- ESH-17-026, "Deficiency Reporting and Correcting"
- ESH-17-036, "Preparing Statements of Work for Analytical Chemistry"
- ESH-17-208, "Evaluation of Biweekly AIRNET Data"
- ESH-17-AIRNET, "Sampling and Analysis Plan for Radiological Air Sampling Network (AIRNET)"
- AIRNET Database Users Guide
- Memo ESH-17:99-104, "Absolute Humidity Calculations and Reporting by the Meteorology Project," Jeff Baars to Distribution, March 10, 1999

Note

Actions specified within this procedure, unless preceded with "should" or "may," are to be considered mandatory guidance (i.e., "shall").

Background

Background   Requirements for chemical analyses are described in the data quality objectives (DQO) section of the AIRNET sampling and Analysis Plan (ESH-17-AIRNET). Data quality objectives from are translated into procurement needs and related Statements of Work (SOW) according to ESH-17-036. Data received from all internal and external chemistry laboratories under these SOWs are uploaded electronically and inspected to determine if they meet ESH-17 specifications. This inspection includes checking the data package received from the laboratory to ensure that:

- the data package contains the components specified in statements of work,
- all of the requested analyses were performed for all samples,
- the data are of a quality adequate for the use which ESH-17 intended.

The analytical data are evaluated to ensure usability and electronic forms are verified against hardcopy data packages, and then archived to protect their integrity.

The analytical chemistry coordinator prepares checklists of the items to address when checking data packages from laboratories after analyses have been completed. Data are either manually entered into the Microsoft Access AIRNET (ambient air) database or uploaded from Electronic Data Deliverables specified in the SOWs. All manually entered data and only a portion of the electronic data (usually 10%) are verified against the hard copy to ensure exact reproduction of the analytical concentrations, and the data usability are evaluated for acceptance, qualification, or rejection. For AIRNET, initial air concentrations and evaluation against action levels is performed and sent to the project technical reviewer, along with summaries of all analytical QC data. When documented data review and proposed actions are received back from the technical reviewer, these actions are posted to the Access databases. Ultimately, all electronic data are archived into limited-access tables to ensure their integrity. All stages of the process are tracked electronically within the AIRNET database.

Preparing checklists for deliverables

When to prepare completeness checklist

The **ESH-17 analytical chemistry coordinator** prepares checklists as needed to evaluate the completeness of any deliverables when new services are procured. Base the checklists on the SOWs, EDDs, electronic database designs, and professional judgment. Tailor the checklist formats to allow easy checking of analyses purchased frequently (such as biweekly gross alpha/beta, tritium or gamma analyses, and quarterly composite analyses for alpha isotopes). As such, the sequence of components may be different in the checklist and SOW, but all content is to be included. It is most convenient to include the checklist as an appendix to each SOW, so that anytime the SOW is modified, the revisions may be immediately incorporated into the completeness checklist.

Examples of checklists are attached to this procedure as Attachments 1 and 2.

Steps to prepare a checklist

Follow these steps to prepare checklists:

Step	Action
1	Consult the relevant SOW, EDD, and AIRNET database design specifications to identify the supporting documentation required.
2	Consult an existing checklist, if available, matching requirements as closely as possible.
3	Obtain a sample package for the analyses from the lab.
4	Prepare the new checklist by modifying an existing checklist to match current requirements and package sequence. Ensure the data reviewers have the current versions.

Processing and evaluating the EDD for AIRNET analytical chemistry data

Upload EDD   EDDs may be received from both internal and external analytical chemistry laboratories. Format and content requirements are specified in each individual Statement of Work prepared according to ESH-17-036. Each EDD requires specific software to enable it to be incorporated into the existing databases. The uploading process is described in detail in the AIRNET Database Users Guide. Upload these EDDs according to these detailed processes as soon after receipt as practical.

Evaluate against SOW requirements   After uploading data received electronically, evaluate these deliverables using software described in detail in the AIRNET Database Users Guide to ensure that the major components are the same as those usually received or required by the SOW.

Resolution   When expected components are missing or errors are detected, contact the lab immediately and request that a revised EDD be sent expeditiously. Also document the problem by preparing a deficiency report according to ESH-17-026.

Steps to calculate preliminary air concentrations for AIRNET   The staff who verify and validate the field data and analytical chemistry data are in the best position to know when both are completed for each biweekly or quarterly composite sample group. Follow the steps below to run the Microsoft Access software that produces these reports and forward them to the technical reviewer responsible for routine review of these data. The actual equations used are given in Attachment 4.

Step	Action
1	Ensure that AIRNET field data have been loaded, verified and validated, and that air volumes have been calculated (via database query) for each field record. Ensure that all analytical data have been uploaded, although the verification and validation process need not yet be complete.
2	Run appropriate queries, using the detailed procedures documented in the AIRNET Database Users Guide, to perform initial air concentration calculations.
3	Perform initial QC sample evaluations using the detailed procedures documented in the AIRNET Database Users Guide. See Attachment 3 for a description of the evaluation criteria employed by these queries.

Processing and evaluating the EDD for AIRNET analytical chemistry data, continued

Step	Action
4	Prepare a detailed internal memo that includes detailed reports of QC evaluations performed and an overall data usability conclusion. The details on the content and preparation of this document may be found in the AIRNET Database Users Guide. Transmit these results to the project technical reviewer and all project leaders for their evaluation and review. The technical review will be performed according to ESH-17-208.

Calculation of completeness parameters

Run-time requirements

The FFCA stations must meet 95% run-time per calendar year. The Consent Decree requires several specific stations to be operated to the same standards as the FFCA stations. The Air Quality group's goal is to achieve 90% run time for all other stations. (See "Completeness" in the AIRNET Sampling and Analysis Plan, ESH-17-AIRNET.) This corresponds to no more than 438 hours and 877 hours, respectively, down-time per year, or on average about 17 hours and 34 hours, respectively, per sampler per sample period. The actual equations used are given in Attachment 4.

Calculating sampler run-time

Calculate the cumulative run-time for the calendar year (as a percentage of total possible annual hours) using MS Access queries designed specifically for that purpose. Then generate and attach this report to the technical review and QC evaluation biweekly memo for gross alpha/beta only. These queries are documented in the AIRNET Database Users Guide. The actual equations used are given in Attachment 4.

Completeness requirements

FFCA data must meet 80% annual completeness requirements (see "Completeness" in the AIRNET Sampling and Analysis Plan). The Consent Decree requires several specified stations to be operated to the same standards as the FFCA stations. The Air Quality group's goal is to achieve 80% sample completeness for all AIRNET stations. For biweekly results, this corresponds to no more than 5 samples lost, not analyzed, or rejected during a calendar year.

Calculating sample completeness

Calculate the completeness for the year to date by dividing the total number of usable biweekly concentration values by the total number of sampling periods to date in the year, using MS Access queries designed specifically for that purpose. Then generate and attach this report to the HP Review and QC Evaluation bi-weekly memo for each analysis group. These queries are documented in the AIRNET Database Users Guide. The actual equations used are given in Attachment 4.

Occasionally, a sampler will not have operated for the complete (biweekly) sample period (common occurrences include power outages or pump failure), but the samples are collected and analyzed. Use best professional judgment to determine if the sample results are representative of the sample period. Calculate sample completeness correspondingly. The **project technical reviewer**, the field team leader, and the **analytical chemistry coordinator**/data base manager decide jointly to reject or qualify data on these bases.

Calculation of completeness parameters, continued

Evaluate datapackage completeness against completeness checklist

After receiving the final hard-copy data package and while the technical reviewer is reviewing the preliminary air concentration calculations and QC evaluations, use the appropriate completeness checklist (prepared as described in the chapter *Preparing checklists for deliverables*) to evaluate the deliverable. If the data are of a frequently purchased type, review to ensure that the major package components are the same as those usually received.

Resolution

When expected components are missing, contact the lab immediately and request that the missing components be sent expeditiously. Also document the problem by preparing a deficiency report according to ESH-17-026.

Custody errors

Custody errors are those which make it difficult to demonstrate that the samples that were shipped by ESH-17 were the same as those analyzed by the lab. Examples include:

- ESH-17 or lab staff not signing and dating chain of custody forms
- Loss or miscounting by ESH-17 or the lab
- Misidentifying by ESH-17 or the lab
- Lost samples
- Delivery to the wrong site or person

Document all custody errors with an ESH-17 Deficiency Report (ESH-17-026). Resolution will require coordination with the lab. If new analyses are necessary, ship the new samples under a new chain of custody.

Purpose of AIRNET analytical chemistry data evaluation

The data evaluation process determines whether chemical analyses data meet the data quality objectives specified in the quality plan (ESH-17-AIRNET). All data will be evaluated for one of three outcomes: *accept*, *qualify*, or *reject*. For qualified and rejected data, an explanation must be included in the database.

Calculation of completeness parameters, continued

Evaluate data Follow the steps below to evaluate the AIRNET data:

Step	Action
1	Using the appropriate sample checklist(s) prepared according to the chapter *Preparing checklists for deliverables*, evaluate for completeness. Each analytical data element should have a value. • For all missing data, ensure an explanation is recorded in the database and label the record as "rejected." If a missing datum can be located, enter the correct value, label the datum "qualified" in the database, and enter the reason for qualification. • If data errors are identified, contact the lab and negotiate for a corrected report. Label data as "rejected" pending resolution with the laboratory.
2	Using the appropriate sample checklist(s) prepared according to the chapter *Preparing checklists for deliverables*, look for values within the expected range. For example, the expected range might be a nominal value with a range of possible values or an MDA which represents a particular dose cutoff (e.g., 0.1 mrem). The AIRNET Sampling and Analysis Plan lists some of the expected values for data elements. Use historical ranges for air concentrations at each station to identify potentially suspect data points for further inspection and validation. The MDA should also be evaluated against the requirements in the SOW to ensure contractual compliance.
3	As a result of step 2, if the element is outside its range of normal values or significantly above the required MDA, identify the record as "qualified." Perform further validation and verification. Consult with the vendor to determine what conditions at their laboratory may have resulted in the data value reported. Examine field records to identify possibilities of contamination during handling. Label any amended analytical records as "qualified" (enter a "Q" in the analytical data qualification field) and describe in the table's comment field the amendments made. Prepare and reference a separate memo if necessary to provide sufficient detail.
4	If a "qualified" data point cannot be logically amended or explained, it may be labeled as "rejected" (enter a "R" in the analytical data qualification field) and the reasons for rejection must be provided in the table's comment field. Prepare and reference a separate memo if necessary to provide sufficient detail.

Calculation of completeness parameters, continued

Technical reviewer action implementation, final data archiving and public release for AIRNET

The technical reviewer responsible for routine review of these data conducts review according to ESH-17-208, documents the outcome, and approves the data for use. Changes in acceptance outcomes are implemented and both field and analytical data are archived in limited access tables for protection from inadvertent modification.

Steps to implement technical review input

Perform the following steps to implement the recommendations and changes from the technical reviewer:

Step	Action
1	After the technical reviewer returns a formal memo listing the changes to be made, implement the recommended actions in the database and document the reasons in the comment field.
2	When both the validation and verification and technical review process are complete, archive both field and analytical chemistry data using the detailed procedures documented in the AIRNET Database Users Guide. These become the official data for use in published compliance or surveillance reports and for release to the public.
3	Publish fully approved data to the ESH-17 WWW homepage using the detailed procedures documented in the AIRNET Database Users Guide.

Evaluation of AIRNET pre-1996 field and analytical data

Purpose of data evaluation

Data collected prior to 1996 were not procured to the same standards, did not have the same data package documentation, and cannot be reviewed to the same level as 1996 and later data. As part of an on-going process, these data are being reviewed to the extent practical and made available electronically in the AIRNET database. Since data are being loaded from a variety of sources using both electronic and manual means, all data must undergo verification and validation to ensure the correctness of the electronic record.

Steps to evaluate data

Perform the following steps to evaluate field sampling and analytical chemistry data:

Step	Action
1	Collect available hard-copy field sampling and analytical chemistry data records for the sampling period being evaluated. Obtain access to a computer terminal connected to the ESH-17 group server.
2	Evaluate for completeness to the extent permitted by the existing records. Each field or analytical data element should have a value. Ensure an explanation is recorded in the database for all missing data. • If a missing datum is without an acceptable explanation, attempt to determine the reason; label the datum "qualified" in the database and enter the reason for qualification. • If unable to determine a reason, leave the field blank and enter "R" in the qualifier field.
3	Evaluate for expected range of values, to the extent permitted by the existing records. For example, the expected range might be a nominal value with a range of possible values. Project quality plans often list some of the expected values for data elements.
4	As a result of step 3, if the element is outside its range of normal values or some field event renders the data potentially suspect, identify the record as "qualified." Perform further validation and verification by consulting with the field sampling technicians to determine what conditions at a site may have resulted in the data value reported. Label any amended field records as "qualified" (enter a "Q" in one of the field data qualification fields - timer, filter or gel) and describe in the table's comment field the amendments made.
5	If the data were not used in prior year's calculations or reports, label the data record as "rejected" (enter a "R" in one of the filed data qualification fields) and provide the reasons for rejection in table's comment field.

Evaluation of AIRNET pre-1996 field and analytical data, continued

Step	Action
6	Move the validated and verified data into the Archive tables within the AIRNET database for use in published reports and for release to the public. Specific procedures are documented in the AIRNET Database Users Guide.

Records resulting from this procedure

Records The following records generated as a result of this procedure are to be submitted **within 3 weeks of their receipt or generation** as records to the records coordinator:

- AIRNET Completeness of Data Package (SOW LANL/ESH-17/GEN) form; completed, signed, and dated
- AIRNET Field Data Validation and Verification Database inspection form; completed, signed and dated.
- AIRNET Analytical Data Validation and Verification Database Inspection form; completed, signed and dated.
- Copy of final laboratory data package
- Deficiency reports resulting from chain-of-custody problems
- ESH-17 internal memos documenting data quality evaluation, data validation, and initial air concentration or emissions calculations

The following electronic records generated as a result of this procedure are to be contained within their respective Microsoft Access databases:

- entries in AIRNET database for all accepted, qualified and rejected data from both field and analytical processes.

Air Quality Group
Checklist for Completeness of Data Package for Gross Alpha, Beta
This form is from ESH-17-033

(Form Version: 5/2/97, SOWs LANL/ESH-17/GEN, 5/1/97   LANL/ESH-17-6, 8/1/99)

AIRNET Sample Group #:_____

Inspection Criterion	Criter met?	Comments
Was analytical lab required to work to the above-listed standard by contract?	Y N NA	
Was an acceptable EDD received within 14 days of lab receipt of samples	Y N NA	
Final Data package received within 30 days of sample arrival at analytical lab?	Y N NA	Date sub: Date rcd:
Each page of each data package sequentially numbered.	Y N NA	
Narrative comments on the analysis of each sample group in cover letter or memo?	Y N NA	
Positive sample id in all tables and reports.	Y N NA	
Positive indication of signatures/initials at each work and review stage.	Y N NA	
Data received for each sample on C-of-C.	Y N NA	
Summary of sample results (to include customer id, sample delivery group or request number, lab id, isotope/analysis, analyte concentration, analyte uncertainty and MDA in the same appropriate units, counting times, and dates of analysis); an individual summary provided for each sample.	Y N NA	
Individual summary of each QA/QC sample (same parameters as sample results); QA/QC samples will include, at a minimum of one each of the following for every 20 field samples: a Laboratory Control Sample (LCS), a detector blank, a matrix blank and a matrix spike.	Y N NA	
Known values for all QA/QC samples?	Y N NA	
Individual sample raw data and individual spectral plots showing regions of interest (ROI) integrated for each gamma isotope.	Y N NA	
Individual QA/QC raw data and individual spectral plots showing ROI integrated for each isotope.	Y N NA	
Individual detector efficiencies and backgrounds.	Y N NA	
Laboratory bench sheets with sample of any manual calculations done.	Y N NA	
Evidence of NIST-traceable calibration standards.	Y N NA	
Copies of the most recent applicable MDA study results, initial calibration and recalibration.	Y N NA	
Chain of custody form.	Y N NA	
All equations used to calculate MDAs or sample results either in datapackage or published analytical procedures.	Y N NA	
Actual concentrations include negative values, rather than some form of "not detected" (less-thans are permitted).	Y N NA	
Uncertainties (identified appropriately as 1, 2, or 3 sigma in the final data package).	Y N NA	

Verified by: _____   Date: _____

Air Quality Group
AIRNET Analytical Data Validation and Verification Database Inspect
This form is from ESH-17-033

Gross Alpha/Beta (8/1/99 version)

AIRNET Sample Group #: _____

Data Element Inspected (Database location)	Complete and Correct in referenced Access table	Comments
Data Package Completeness check performed	Y - N	
Data V&V method used All manually entered 10% of EDD	Y - - NA Y - - NA	
ANAL DATA FOR V&V table		
AIRNET Sample Period #	Y - N - NA	
AIRNET Sample ID number	Y - N - NA	
Location # = AIRNET ID after decimal point?	Y - N - NA	
Anal Lab sample ID	Y - N - NA	
Analysis	Y - N - NA	
< in Symbol field, if approp.	Y - N - NA	
Result	Y - N - NA	
Uncertainty	Y - N - NA	
Units	Y - N - NA	
MDA	Y - N - NA	
Comment	Y - N - NA	
Master Site Numbers	Y - N	
Data Qualifiers in use	Y - N	
SAMPLE & DATA TRACKING table		
Anal. Lab code entered	Y - N	
Date Submitted	Y - N - NA	
Date Received	Y - N - NA	
Anal Lab SDG #	Y - N - NA	
Lab Analytical Procedure #	Y - N	
Filter fractions complete	Y - N	
Uncer & MDA precision chara.	Y - N - NA	

Verified by: _____   Date: _____

ATTACHMENT 3

QC EVALUATIONS PERFORMED

Type of Data	Evaluation Performed	Acceptance Criteria
All	Laboratory Control Standard (LCS) recovery check	100 ±10%
All except Alpha/Beta	Process Blank (PB)	See Control Criteria below
All	Matrix Blank (MB)	See Control Criteria below
All	Trip Blank (TB)	See Control Criteria below
Alpha, Beta, H-3, alpha isotopics and Be	Matrix Replicate evaluation	For analytically significant, positive results, similar to control criteria below.
Gamma	Matrix Replicate evaluation	Qualitative agreement (within a factor of 5) for analytically insignificant results (i.e. less-than values).
Be, H-3 and alpha isotopics	Matrix Spike	100 ±10% of added spike
All	MDA achieved	All samples below SOW specification
All	Missing Field or Analytical data	No missing data for actual field samples
Tritium	Collection efficiency	Between 50 and 130 % of theoretical
Gamma	"Naturals"	All should have positive results
Gamma	"Artificials"	Compare calculated dose to 0.5 mrem target
Each bi-weekly period, reported with alpha/beta	Sampling Station Run Time completeness	95% up-time for FFCA and Consent Decree stations, 90% up-time for all others
All	Analytical Completeness	80% successful analysis of valid samples
Alpha/beta, H-3, alpha isotopics	Action Level Comparison	< 100% of target value

General Control criteria:
"Under control" is within <= 2s of annual mean for that QC type
"Warning" is between 2s and 3s of annual mean for that QC type
"Out of control" is >= 3s of annual mean for that QC type

DATA PARAMETERS

This table lists important equations used to calculate critical AIRNET data parameters. These equations are implemented in queries in the AIRNET MS Access database. The complete data evaluation process is described in the AIRNET Sampling and Analysis plan (ESH-17-AIRNET), this procedure, procedure ESH-17-208, and procedure ESH-17-223.

Parameter	Description	Equation
Alpha and beta air concentration	Average concentration of alpha and beta in the air for the actual sampling period.	C (pCi/m^3) = A (pCi) / V (m^3)
Am, Pu, and U air concentration	Average concentration of Am, Pu, and U in the air for the actual sampling period.	C (aCi/m^3) = A (pCi) $*10^6$ / V (m^3)
Tritium air concentration	Average concentration of tritium in the air for the actual sampling period.	C (pCi/m^3) = A (pCi) / AH
Absolute humidity	Average of weekly absolute humidity (gm/m^3) measured by the Meteorology Project* during each week of sampling period.	AH_1, AH_2 = average humidity for 1st and 2nd weeks of period* $AH = (AH_1 + AH_2) / 2$ (for 3-week sample periods, average 3 weekly AH_n values)
Activity in sample: alpha and beta	Activity, in pCi, as measured by the analytical laboratory.	$A_{\alpha\beta}$ (pCi) = A (pCi, alpha/beta) / filter fraction.
Activity in sample: tritium	Activity, in pCi, in the collected water.	A_t (pCi) = A (pCi tritium/ml, as measured by lab)
Possible run hours	Total hours within current sample year between start and stop of sample collection.	$T_{f,p}$, $T_{t,p}$ = [(stop date of current sampling period in CY) - (start date of initial sampling period in CY)] * 24 (Normally the same for both filter and tritium samples.)
Actual run hours	Actual hrs the samplers collected particles or tritium during current sample year.	$T_{f,a}$, $T_{t,a}$ = Sum of $T_{f,a}$, $T_{t,a}$ over all sampling periods to date within current CY (Normally the same for both filter and tritium samples.)
Runtime percentage	The percent of total possible runtime that the sampler actually collected sample; for both the filter and tritium.	$RT_t = (T_{t,a} / T_{t,p})$ x 100 $RT_f = (T_{f,a} / T_{f,p})$ x 100 (Normally the same for both filter and tritium samples.)
Actual filter air volume	Volume, in m^3, of air sampled by the station.	V_f (m^3) = $T_{f,a}$ x [(start filt flow + end filt flow) / 2] x 0.02832 (m^3/ft^3) x 60 (min/hr)
Actual tritium air volume	Volume, in m^3, of air sampled by the station.	V_t (m^3) = $T_{f,a}$ x [(start tritium flow + end tritium flow) / 2] x 1e-6 (m^3/cc)
Sample completeness	The percent of total possible samples taken that were analyzed successfully.	C% = Sum of (number of sample data by analysis reported from lab) / (number of sampling periods in current sampling year)

Equation subscripts: f = filter; t = tritium; a = actual; p = possible   * AH calculations are documented in memo ESH-17:99-104.